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Experiences From Creating the Guide to the Systems Engineering Body of Knowledge (SEBoK) v. 1.0

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Abstract

Version 1.0 of the Guide to the Systems Engineering Body of Knowledge (SEBoK) was released in September 2012. Seventy authors from around the world working for three years created the SEBoK. This paper discusses twelve factors that were critical to the successful development and on-time release of the SEBoK. The approach taken is elaborated, and lessons learned along the way are highlighted. These experiences and recommendations based on them would be useful to any collaborative research effort that shares one or more of the characteristics of SEBoK development.

Keywords: Systems Engineering; Body of Knowledge; Experiences; Collaboration

1. Introduction

The objective of this paper is to share the experiences gained during the development and successful on-schedule release of version 1.0 of the Guide to Systems Engineering Body of Knowledge (SEBoK). The paper also offers recommendations based on those experiences, that could be valuable to any collaborative research effort that shares many of the central characteristics, such as being largely a volunteer effort, including professional society participation, and involving a large number of authors from diverse locations, employers, and backgrounds. However, the objective of this paper is not to elaborate on the principles and methods that were adopted during the development of SEBoK.

In September 2009, the Body of Knowledge and Curriculum to Advance Systems Engineering (BKCASE™) project was established with primary sponsorship by the U.S. Department of Defense (DoD) through the Systems

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14. ABSTRACT

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Engineering Research Center (SERC). It was a university led partnership between Stevens Institute of Technology, Hoboken, NJ and Naval Postgraduate School, Monterey, CA, with support from various other universities, organizations, government agencies, and professional societies. The objective of the BKCASE project was to create and deliver two products: (1) Guide to the Systems Engineering Body of Knowledge (SEBoK) by September 2012 and (2) Graduate Reference Curriculum for Systems Engineering (GRCSE) by December 2012. Both these products are intended for worldwide use, available for public use at no cost. At the time of writing this paper, version 1.0 of SEBoK had been released on September 14, 2012 [1] and version 1.0 of GRCSE was on track for release on December 15, 2012.

The project charter of the BKCASE project [2] summarizes the current state of the Systems Engineering (SE) discipline; the intent behind creating the SEBoK; and the value proposition of the SEBoK:

- *There is no authoritative source that defines and organizes the knowledge of the SE discipline.*
- *The resulting knowledge gap creates unnecessary inconsistency and confusion in understanding SE.*
- *The process of creating the SEBoK will help build community consensus on the boundaries and context of SE.*
- *Having a common way to refer to SE knowledge will facilitate communication among systems engineers and provide a baseline for competency models, certification programs, educational programs, and other workforce development initiatives around the world.*

While the SEBoK development effort is significant, foundational, and unique for the discipline of SE, it may be generally characterized as below:

- International author team of 70 members from 10 different countries;
- Collaborative concurrent authorship;
- Published as a wiki over the Internet for free public use;
- Confluence of academia, industry, government agencies, and professional societies;
- Convergence of different backgrounds, experiences, philosophies, approaches, and perspectives on SE;
- Multi-year effort (3 years for development of SEBoK v. 1.0 to be followed by periodic updates and releases);
- Large scale (primary content is about 850 pages, not including glossary terms, annotations, acronyms, etc.); and
- Distributed direct funding and in-direct funding.

The SEBoK is a significant contribution to the discipline of systems engineering, and is a valuable resource for systems engineering research. In addition to providing informative insight to its many users, the experiences gained from developing the SEBoK, lessons learned, and recommendations reported in this paper would also be valuable to any similar development effort that shares one or more of the above characteristics.

2. Twelve Critical Factors

Managing the development of the SEBoK since initiation in 2009 until the release of version 1.0 in September 2012 has been a rich, valuable, and rewarding experience to everyone involved, particularly to the authors of this paper: the core editorial team of the SEBoK. These experiences have been gathered under twelve critical factors. Listed in no particular order, the manner in which each of the following factors was addressed played a significant role in the successful on-schedule release of SEBoK v. 1.0: (1) Content Sourcing and Organization; (2) Roles and Responsibilities; (3) Collaboration: Modes & Tools; (4) Content: Style, Quality, and Integration; (5) Internal Review and Editing; (6) Wiki Environment; (7) Intellectual Property and Copyright; (8) Outreach and Community Review; (9) Rollout Activities; (10) Sponsorship; (11) Stewardship; and (12) Updates and Future Versions.

In the following sections, the approach taken for each of the above factors is discussed along with challenges faced and experiences gained. Lessons learned are summarized as recommendations. These factors are neither exclusive nor do they indicate any sequence of steps or process. There is significant overlap between them, and they also strongly influence each other. Further, this list is not exhaustive, but does represent the most important ones in the opinion of the authors of this paper. This offers a good starting checklist for any comparable effort.

2.1. Content Sourcing and Organization

The SEBoK is a guide to the SE knowledge, pointing to important books, papers, and websites, and not an exhaustive resource that captures all available SE knowledge directly. Therefore, while the identification of appropriate SE literature was critically important, the balance between what content should actually be included in the SEBoK and what content should only be pointed to from within the SEBoK to other external sources, was not easy to achieve.

SE Literature: The most comprehensive source of SE knowledge today is the Systems Engineering Handbook [3] prepared by the International Council on Systems Engineering (INCOSE). In fact, the initial version of the SE handbook was used in INCOSE's efforts to create a guide to the systems engineering body of knowledge (G2SEBOK) in 2002 [4] that was subsequently discontinued. SE literature also includes many standards such as ISO/IEC/IEEE 15288 [5], models such as CMMI [6], guidebooks such as MITRE SE Guide [7], and textbooks such as Systems Engineering and Analysis [8]. SE related articles are published in the Systems Engineering Journal and many other technical journals.

Organization of SEBoK Content: Two other bodies of knowledge that may be comparable to the SEBoK in content, purpose, and usability, are the Software Engineering Body of Knowledge (SWEBOK) [9] and A Guide to the Project Management Body of Knowledge (PMBOK® Guide) [10]. The SEBoK structure was initially patterned on the INCOSE SE Handbook and the ISO/IEC/IEEE 15288 standard, but the SEBoK structure evolved significantly over time. At the time of SEBoK v. 1.0 release, the content was organized in a manner somewhat analogous to that of the SWEBOK. The lowest organizational unit in the SEBoK is a "topic". Related topics are gathered under "knowledge areas", and related knowledge areas are gathered under seven "parts" of the SEBoK. There are 26 knowledge areas and 112 topics in SEBoK v. 1.0. Every part, knowledge area, and topic of the SEBoK has an "article" written on it.

Organization of SE Literature within SEBoK: Due to the nature of the SEBoK, it was imperative that every article cite and point to relevant SE literature that would provide further elaboration and detail. However, each SEBoK article also included sufficient discussion of the topic to provide the reader a reasonable understanding of the topic even within the SEBoK. The references for each article are organized under three categories: (1) **Works cited** include all references directly cited in the SEBoK article; (2) **Primary references** include select references that are key to the topic of the article, and are strongly recommended for further reading - SEBoK v. 1.0 includes 224 primary references; and (3) **Additional references** include other related literature that are good sources of additional information beyond the primary references and the particular sections cited in that SEBoK article.

Recommendations:
- Clearly identify the critical sources for content. While they are imperative for any "body of knowledge", they are equally important for any reference resource.
- Establish an initial structure into which content can be populated, but expect the structure to evolve. Look for similar works for a good starting point, but expect and allow the final structure to emerge. Using an analog from agile software, expect to refactor the document architecture repeatedly as the effort progresses.

2.2. Roles and Responsibilities

The management and authoring responsibilities of the SEBoK were successfully executed by a diverse set of individuals. They contributed individually, as part of a small group or groups, as leaders, and as administrators. These significant roles and the responsibilities are highlighted here.

Authors: Authors played the critical role of identifying the right mix of SE literature for inclusion in the SEBoK and also wrote the SEBoK articles. They were an intentional blend of academicians and industry professionals from the Americas, Europe, Asia and Australia. This brought in a variety of SE backgrounds and perspectives and had two other significant impacts: (1) the SEBoK could be created keeping a global audience in mind and (2) the time zones and multiple native languages added further challenges to the collaborative effort. Authors were continually recruited to the SEBoK author team based on discovered gaps in requisite expertise, usually relying on existing SEBoK authors to find new recruits. Authors volunteered their time for the SEBoK effort without any direct

monetary compensation from the BKCASE project.

Part Team Leads: Authors were grouped under each of the seven parts of the SEBoK, with one of them serving as the lead of the team. This ensured better communication, collaboration, and effective working of the authors. The part team lead (PTL) was responsible for coordinating the work of the authors and for meeting the project deadlines.

Core Team: The core team consisted of six members from Stevens Institute of Technology, Naval Postgraduate School, and Sevatec, a private company. It provided overall leadership and played three significant roles: (1) a high-level management team that provided overall guidance, support, event planning, and execution of every activity and event of SEBoK development, (2) an editorial team that was responsible for ensuring the quality of the content of the SEBoK, including the glossary, acronyms, and primary references, and (3) a publication team that handled packaging and release of the SEBoK. The core team planned project milestones, supported every part team lead, organized workshop and meetings of the authors, spearheaded various outreach and publicity activities, provided most of the administrative and technical support to the entire project, and managed all the legal and related issues of the SEBoK. The core team also took a lead in forming specialty teams at various stages as unique needs arose. The core team (and the BKCASE project) was led by a principal investigator and assisted by a co-principal investigator, who had final authority and responsibility for the project.

SERC Office: The BKCASE project was one of the research tasks of the Systems Engineering Research Center (SERC), which is a DoD University Affiliated Research Center managed by Stevens Institute of Technology. The SERC provided back-end support, funded most of the core team's time and some author travel, and acted as a liaison for the primary sponsor.

Recommendations:

- Authors and their dedication play an enormous role in project success. Find technically qualified authors with the right collaborative spirit, a willingness to work as a team and honor their roles, adhere to deadlines, deal with the difficulties of a large diverse team, and maintain a sense of humor throughout a long effort. This will not be easy, but is critical. How well author candidates will fit into the team, must also be considered.

- A core team is extremely important to manage and execute a large-scale project. The size and composition of the core team would depend on a number of factors, but a lean team is recommended.

2.3. Collaboration: Modes & Tools

A number of modes and tools were employed to support collaboration and communication.

Emails, Mailing Lists, and Cloud Storage: Thousands of emails were exchanged between the authors, core team members, and others involved with the SEBoK. A mailing list of the entire group of SEBoK authors was used for bulk communication. Cloud space was utilized for online storage and sharing of files between the authors, within part teams, and within the core team.

Virtual Meetings: Because the SEBoK authors were geographically dispersed, virtual meetings using Internet-based technologies were both common and essential. WebEx is a web conferencing and collaboration product used by BKCASE. WebEx sessions were the most common method of meeting for the core team (that met every week for the entire length of the project), and the part teams.

Face-to-face Meetings: Electronic communication, while essential, did not substitute for periodic face-to-face meetings that were essential to take stock of progress, to build team rapport, and for deliberations and decision-making on important issues. Workshops conducted every three or four months, brought together 20 to 30 authors for two or three days. The first workshop was held at Naval Postgraduate School in December 2009 and the twelfth (last) workshop was held at Stevens Institute of Technology in October 2012. Other workshops were held throughout the US and Europe, often co-located with other international SE events and conferences. At these workshops, the authors made significant decisions that shaped the structure and content of the SEBoK. The value of the workshops was increased by well-planned agendas, and each meeting had an announced set of objectives. Thorough and detailed meeting reports assured that the results were disseminated to parties wsho could not attend.

Recommendations:

- A variety of online collaboration tools (emails, mailing lists, cloud storage, virtual meetings) is required for any large collaborative effort. It is important that all participants are able to access and use these tools. Access restrictions imposed by some organizations can pose special problems that must be addressed; e.g., some companies would not allow WebEx to be used inside their corporate firewalls.
- Hold face-to-face meetings. To minimize cost and facilitate easy travel, meeting locations should be based on where the authors live and where events of common interest are held.

2.4. Content Style, Quality, and Integration

The SEBoK is not just a collection of individual contributions by various authors. It is a single product that was collaboratively developed by 70 authors. Ensuring that the SEBoK looks, reads, and feels like a single body of work was important.

Article Format: To ensure consistency and quality across all SEBoK articles, the approximate length and expected coverage of articles were specified. Articles had to be descriptive, not prescriptive, reflect the opinions and views of several authors, and had to objectively point to relevant SE sources for further details. Moreover, authors would frequently comment on the work of others and volunteer to help out wherever needed. For this reason, individual articles are not attributed to individual authors; i.e., there are no bylines for the articles.

Style Guide: The core team prepared a comprehensive style guide for all authors to use. The style guide explained the expected format of an article, how that article should link to others within the SEBoK, how to define and reference glossary terms, cite references, and format figures and tables. The style guide was continually updated as the project progressed, and it also provided a basis for editing of the SEBoK.

Integration of Content: While the style guide helped maintain a consistent feel across the SEBoK, the content needed to be integrated at a deeper level. The usage and perceived understanding of a term should be consistent across the SEBoK, irrespective of who wrote the article or where in the SEBoK the article fit. In some ways, this was the most challenging aspect of the writing, given the many different perspectives and schools of thought within the SE discipline. Groups were formed just to look over the SEBoK articles and look for places where terms were used inconsistently with each other and with the glossary definitions. This was very challenging and only imperfectly implemented in version 1.0. Subsequent SEBoK versions will continue to strengthen content integration.

Recommendations:
- In any effort involving a large number of contributors, establish detailed guidance on content format to ensure consistency.
- Establish continuously applied mechanisms to ensure consistency not just in the style but also in the semantics of the content to ensure that readers gain a consistent, unambiguous, and valuable understanding.

2.5. Review and Editing

In spite of detailed style guidance and other instructions, a thorough review and editing of all content was essential. Individual authors have their own writing styles, and some of them may focus attention on the content per se and not so much on formatting related issues.

Internal Review and Editing: Authors and the respective part team leads did their own review and editing after an article was written to ensure compliance with the style guide and other instructions. However, the core team performed the bulk of the review and editing. Activities included proofreading for typographical errors; citing and listing references in the correct format; ensuring proper application of both internal and external links, ensuring proper formatting of tables and figures; checking consistent usage of acronyms and glossary terms; ensuring proper capitalization; and verifying correctness and validity of the content. Because so much of getting the style correct was manual and often very detailed, the authors simply did not generally do this well even when they tried.

Technical Editing: Professional technical editors were hired to aid the editing of all content. Every SEBoK article underwent at least one round of technical editing. Articles that required extra rounds of technical editing were

flagged during internal review either by authors or by the core team. Most often, core team editing and technical editing happened in parallel, but both groups working on the same article at any point in time was avoided.

Recommendations:
- More important that developing a style guide, verify that the guidance is being followed.
- In addition to all the internal efforts in reviewing and editing, engage suitable external professional help for large bodies of work.

2.6. Wiki Environment

One of the most useful characteristics of the SEBoK is its wiki environment. While SEBoK v. 0.25, was released in a Portable Document Format (PDF) document, subsequent interim versions and SEBoK v. 1.0 were released as a wiki. This dramatically shifted how content was generated, edited, reviewed, and published [11], and introduced significant workload into the project to establish a stable wiki environment that was tailored to how the SEBoK authors wanted it to appear and have specific navigation and other features.

Content Generation and Editing: The wiki is designed for collaborative development, providing a convenient platform for easy and quick content generation. Wiki editors need to be familiar with the technical language that is used to specify elements of a page such as section titles, formatting, tables, etc. Every SEBoK author underwent training on the wiki environment and its features. Though each author would directly work on only a few of the SEBoK articles, permissions allowed an author to edit any wiki page. This eliminated administrative overheads of assigning specific page permissions to specific authors, and worked reasonably well among the author community, who had to work cooperatively to avoid degrading the articles.

Tools and Controls: The wiki environment provided a number of tools to help content generators, editors, and administrators. For example, it is easy to find all wiki pages that link to a particular page, or to know the entire editing history of a particular page. Permissions for each group of users can be specified; therefore permission to create or delete pages can be restricted to a few administrators only, while all authors may be able to edit content in existing pages. It is possible to maintain a private site that is accessible only to authorized users where all development and testing can be done before releasing the site to the public.

User Experience: Wiki users can do more in a wiki environment than in a traditional website, and much more than in a PDF document; SEBoK includes several navigation features. Links from within articles takes a user to other related articles or glossary pages. Most importantly, a user can quickly provide feedback on the wiki page.

Recommendations:
- Wiki is a powerful versatile environment for collaborative development, but before letting contributors to begin working on it, set up the overall structure, features, tools, accounts, and permissions.
- Publishing on a wiki is unlike publishing a book that would be stable until the next edition. Keep the content dynamic and make frequent updates as required.
- A wiki environment is fairly complex, requiring special skills to maintain and customize. Put someone in charge of the wiki environment, supported by people who understand the underlying information technology.

2.7. Intellectual Property and Copyright

Intellectual property and copyright issues needed to be addressed for two kinds of content: (1) content sourced from other literature for use within the SEBoK and (2) distribution and use of content generated by the SEBoK authors.

Content Sourced from Elsewhere: Being a guide to the body of knowledge, the SEBoK references a large number of SE resources including books, articles, and websites. Citing these resources in a proper ethical manner without plagiarizing the content but ensuring fair use is mandatory. In addition, SEBoK articles also reference

figures, illustrations, and tables that would benefit the SEBoK reader if they were included directly in the SEBoK. This requires using copyrighted images and other content. Each publisher of textbooks or journal papers has varying rules for protecting their intellectual property and extending copyright permissions. In many cases, SEBoK authors who wished to include content that they themselves had authored outside the BKCASE project, did not themselves own the copyright. Rather, other publishers owned the copyright. The procedure, time and effort involved varied significantly between publishers. A full list of all copyrighted images being used in the SEBoK was maintained, and copyright permissions were obtained for all of them. Further, most publishers required standard phrases to be included along with the figure or table in the SEBoK, which were include in the caption of the images when applicable. Management of the third party intellectual property was on the critical path for the project, and a significant risk to on-time completion. This risk was increased when SEBoK shifted from print media to wiki media, and had to re-secure permissions. Institutional lawyers were risk –averse and not familiar with the nuances of permissions in the complicated publishing scheme, and their review took much longer than anticipated.

Author-Generated Content: The authors wrote the SEBoK articles as part of SEBoK development effort, including a number of original figures and tables. The authors signed over the copyright of their work to Stevens Institute of Technology, which holds a compilation copyright to the SEBoK. The SEBoK is published as a compilation, including the third party material, under the terms of a Creative Commons License (CC BY-NC-ND 3.0) [12]. This license does not permit commercial use of the SEBoK. Adoption of this standard licensing scheme greatly simplified the legal review.

Recommendations:
• Identify all copyrighted third party material early in the development. Begin discussions early with the respective publishers. There will be many twists and turns in getting all the needed permissions. Allow plenty of time to sort out issues as they emerge.
• Specify how intellectual property of individual authors will be handled and get signed agreement from each author when he or she joins the project.

2.8. Outreach and Community Review

Community engagement and review was essential to ensure that the SEBoK is relevant, useful and acceptable. For this reason, as well as to help pace the author team, the project released three interim versions of the SEBoK: version 0.25 was a prototype, version 0.5 was intended for early adopters, and version 0.75 was a pre-final version.

Conferences: Annual systems engineering conferences, including the INCOSE International Symposium, Conference on Systems Engineering Research (CSER) and the annual systems engineering conference of National Defense Industrial Association (NDIA), were key events where the SEBoK was featured. The SEBoK authors, usually lead by the core team, presented papers and delivered presentations in each of these conferences from the beginning of the SEBoK effort. In addition, tutorials were conducted since SEBoK version 0.5 was released and panels were held periodically on different aspects of the SEBoK.
Other Outreach: In addition to conferences, authors presented the SEBoK at the INCOSE International Workshops, wrote articles for INCOSE Insight, and delivered informational talks at various other meetings and gatherings. Together, these efforts exposed the SE community to the SEBoK well before the release of version 1.0.
Community Review: The SEBoK authors sought three rounds of community feedback. While outreach activities spread the word about SEBoK, the interim releases of SEBoK provided an opportunity for the community to provide direct feedback comments and suggestions on the content. A list of reviewers was initially created based on recommendations from the author team for a closed review of version 0.25. Over time, this list expanded to over 200 reviewers for public review of versions 0.5 and 0.75. Reviewers provided their feedback through pre-designed forms, emails and in separate documents. In addition, with the transition to the wiki environment, some reviewers offered feedback directly on the wiki site. Following the release of a SEBoK version, review comments were accepted until a specific time. After that, all comments were compiled and the author team reviewed them. The

resulting actions varied from accepting a review comment and making the suggested change to deferring the suggested action to future versions of the SEBoK or simply rejecting a comment for some good and valid reason. Each version of the SEBoK reported the adjudication of comments received on the previous version.

Recommendations:
- Spread the word repeatedly through a variety of channels, beginning long before a useful version of the product is available and continuing through final release.
- Gather review comments from the target audience during development and adjudicate each comment to ensure that all comments are properly considered, and demonstrate to the reviewers and the broader community that review comments are incorporated into the product.

2.9. Roll Out Activities

Preparing a SEBoK version for release involved many activities, such as ensuring all the links on the wiki were valid, preparing press releases, and preparing emails for reviewers, sponsors, and authors.

SEBoK Release: Since moving to the wiki platform, there were two SEBoK sites that co-existed: (1) A public site that was visible across the Internet, and (2) a private protected site where authors were developing the next version of the SEBoK. Releasing the SEBoK involved making the development site public and taking down what had previously been the public site. This involved correcting all the addresses and links to webpages. At any point, the public site could not be edited (except for wiki administrators), but would be open to review comments by any visitor. As release neared, the authors were not allowed to make changes in the wiki. The core team would a spend a few days together discussing release related issues and performing final editing of the entire SEBoK, which would then be ready for release.

Announcements: Immediately following each release, a number of notifications were sent out. The authors were informed of this release, thanking them for their efforts and requesting them to further spread the word. All sponsors and supporting agencies and professional bodies were also informed of the release. Official press releases were issued and featured in websites and other publications. Emails were also sent out to SEBoK reviewers and other members of the SE community announcing the SEBoK release. All these communications and the respective recipients were prepared and identified in advance of the actual release date and time.

Recommendations:
- Spread information about a release widely and concurrent with the release. Be sure to thank all those involved in the project, including authors, reviewers, and sponsors.

2.10. Sponsorship

Two types of funding have supported the SEBoK development and other related activities.

Direct Funding: The office of the Deputy Assistant Secretary of Defense for Systems Engineering (DASD/SE), DoD sponsor for the BKCASE Project, has provided substantial funding for the SEBoK through the SERC. They supported SEBoK leadership (core team) manpower, technical and administrative infrastructure, and travel support to the core team and some authors to attend workshops, conferences, and other events. However, DASD/SE did not influence the content of the SEBoK, composition of the author team, or the development and release mechanisms. DASD/SE provided this support because they believe that the expected benefits to the broad SE community will equally benefit DoD. Further, they believe that taking a hands-off approach to SEBoK development and content will yield the best product.

Indirect Funding: Virtually every organization that was represented in the SEBoK author team indirectly funded the SEBoK activity. Authors volunteered their time; their parent organizations permitted use of their time and resources for SEBoK. Further, many organizations funded author travel to meetings, workshop, and conferences. For every dollar invested by DoD, it is estimated that others invested approximately two dollars.

Recommendations:
- Identify the total funding required early, including different types of funding. Line up the investors in the effort.
- Establish constraints and expectations for investment and ensure all parties understand them. Continuously work to meet all such constraints and expectations.

2.11. Stewardship

While DASD/SE, DoD, was the primary sponsor for the development effort, beginning January 2013, SEBoK will migrate to a shared governance structure between INCOSE, the Institute of Electrical and Electronic Engineers – Computer Society (IEEE–CS), and the SERC. These three organizations would be the stewards of the two products of the BKCASE project – SEBoK and GRCSE; forming a governing board that will guide and oversee the maintenance of the current versions and development of future versions.

Engagement of Stewards: Representatives of INCOSE and IEEE–CS engaged the BKCASE leadership from the very beginning and participated in SEBoK development. Both organizations contributed authors and held regular meetings with the SEBoK leadership to establish expectations and to shape governance post version 1.0. Draft agreements were circulated months before version 1.0 was released to facilitate vetting within the three steward organizations. The structure of the editorial board and mechanisms for future releases were discussed. Current SEBoK leadership will continue and DASD/SE will continue to fund transition activities, but at a lower level than was available for development.

Community and Author Engagement: Despite the anticipated changes in the governance, the SEBoK will continue to rely heavily on volunteer authors and reviewers from across the SE community. Over time, new authors will join the team, seasoned authors will leave, and the underlying infrastructure to support collaboration will evolve. Ensuring continuous engagement of the community and relevant authors, and generating and publishing subsequent versions of the SEBoK will remain challenging.

Recommendations:
- Maintain a life-cycle perspective of the product. Resources required for this sustainment (manpower, funding, infrastructure) must be identified and obtained in advance.
- Identify and resolve early among the stewards, any differences in expectations and future responsibilities.

2.12. Updates and Future Versions

Interim versions prior to release of SEBoK v. 1.0 played a significant role in shaping the structure and content.

Pre-SEBoK v. 1.0 Releases: The three interim developmental releases of SEBoK, v. 0.25, 0.5, and 0.75, created breakpoints to introduce changes in the architecture and content. Review comments, as well as the addition of new authors and deliberations during workshops and other meetings, drove most of the updates to the SEBoK. Major structural changes were performed in SEBoK v. 0.5, but nearing the release of SEBoK v. 1.0, structural changes were minimal. Changing the structure meant modifying the Table of Contents, updating links to and from the affected articles, and checking for inconsistent content. While authors were given permission to make content changes within an article, only wiki administrators could make structural changes, which required the approval of a change management board. Proposed changes to the architecture faced extra scrutiny because of their impact.

Post-SEBoK v. 1.0 Releases: SE is a rapidly changing discipline, and it is imperative to keep the content of the SEBoK current and valid, perpetually. Accordingly, post SEBoK v. 1.0 releases have been planned for the future, and the next immediate version, SEBoK v. 1.0.1, has already been released on November 30, 2012 which includes minor changes and corrections to SEBoK v. 1.0. Similar minor updates will produce SEBoK v. 1.0.x versions, as needed. Every six months, more significant updates will produce SEBoK v. 1.x versions. SEBoK v 2.0 is unlikely to be produced until 2015 or 2016.

Recommendations:
- Continually seek feedback from the end users to identify deficiencies and opportunities for improvements.
- Establish a governance structure to ensure the product will be refreshed commensurate with the rate of change in the field or other relevant factors. Plan for new releases as required.

3. Conclusion

Some BKCASE authors have participated in other large, collaborative writing projects before, but the scale of the SEBoK and the magnitude of the effort broke new ground for the entire team. The factors discussed in this paper may not constitute many surprises in hindsight. But it is strongly recommended that leaders and participants of similar projects explicitly identify and address these critical factors from the very beginning.

Acknowledgements

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